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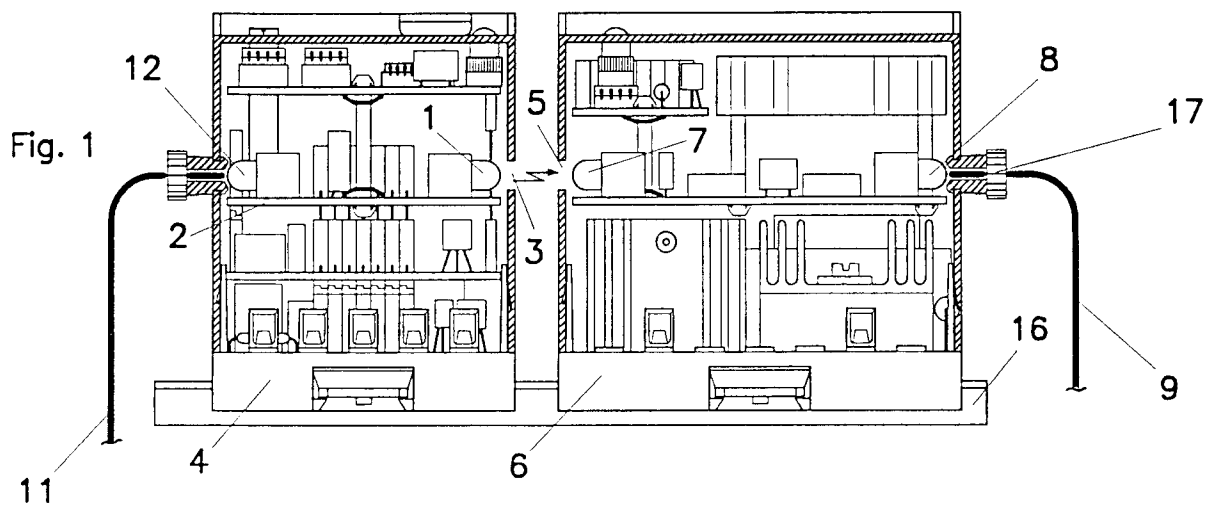
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Optical-electronic system for the intercommunication of commands among electrical devices.

System for transmitting electrical signals, suitable to be integrated in electrical devices used in electrical panels for the distribution and control of electric power, characterized in that transmission is achieved by means of two cells, one first cell (3) for

transmitting the signals and one second cell (7) for receiving them, said cells being mounted on the two opposite sides of said electrical devices (4, 6), which are fixed on the standardized guides (16).



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The present invention relates to a system for transmitting electrical signals which is suitable to be used particularly in electrical devices used in electrical panels for the distribution and control of electric power. Electrical devices used to control and distribute electric power currently provide for three types of connection: 1) connection to the electric power supply line; 2) connection to the load to be supplied with power; 3) connection among the various devices and/or to actuation and/or control elements which can be included in the same panel or be provided externally. This last type relates to electrical connections which are commonly termed "command" or "logic" connections, which must be produced by means of known electric wiring systems.

Since the other two types of connection mentioned above require wiring materials and techniques suitable for heavy currents, the personnel assigned to these activities uses these techniques and materials also to provide the "command" or "logic" connections, although the nature of the electrical signals which flow through these connections does not require the use of these materials but would require materials which are enormously undersized both in terms of required copper cross-sections and in terms of electrical insulation. As electrical devices for the distribution and control of electric power have evolved, control and interconnection circuits have progressively increased; due to the above mentioned reasons, these circuits are formed with expensive and oversized materials, with a considerable expenditure of time to produce the connections and with considerable space occupation within the electrical panels.

The aim of the present invention is to provide users with a system which allows fully to avoid execution of the above described wiring, obviating the above mentioned difficulties by means of a solution which is easy and economical to produce and virtually eliminates the need to physically produce "logic" connections, the waste of expensive accessories and material, and the waste of space inside the electrical panels and the wiring raceways.

This aim, these objects and others are achieved by the system according to the invention, which comprises an optical transmission system and an optical reception system which are characterized in that they are tuned to the same frequency as the generated and detected radiation; advantageously, the optical transmitter is constituted by a solid-state lamp and by the electronic circuit associated therewith, whereas the receiver consists of a solid-state sensor and of the electronic circuit associated therewith, a transmitter and a receiver being advantageously arranged at the opposite sides of each device to be controlled so

as to form a chain between the control device and the controlled devices.

Further characteristics and advantages of the invention will become apparent from a preferred but not exclusive embodiment of the system, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a sectional view of two devices arranged side by side according to a standard method which provides for the coupling of said devices on a standardized metal supporting guide 16;

figure 2 is a view of a chain of devices which are not aligned with the preceding ones; and figure 3 is a view of an external control device complete with electro-optical interface.

The illustrated system comprises a solid-state lamp 1 which is appropriately supported by a printed circuit board 2; the lamp 1 is appropriately directed toward a hole 3, formed in the wall of the case of the device 4, and a second adjacent hole 5, formed in the wall of the container of the second device 6; the sensor 7 is aligned with said holes 3 and 5. The transmission and reception cells may be constituted by solid-state devices which operate in the infrared range. The holes 3 and 5, formed in the walls of the cases of the devices 4 and 6, can be omitted by using plastic materials which are transparent to infrared rays to build said cases.

The operation of the system according to the invention is as follows. An electronic signal which corresponds to a command is sent to the lamp 1; the lamp emits radiation which passes through the holes 3 and 5, striking the detection device 7, which converts the radiation into a corresponding electric signal which is sent to the electronics provided in the second device 6. The same signal is sent to the solid-state lamp 8, which emits a signal which corresponds to the received signal, making it available to other modules which are cascade-connected. The electrical signals which drive the transmission cells 3 are modulated at high frequencies and a low-pass amplifier is connected to the receiving device 7, so that external artificial or natural light does not affect the operation of the device.

If a device which is also provided with the opto-electronic coupling system described in the present patent cannot be mounted in an aligned manner and proximate to the end of the chain constituted by the other devices, it is possible to recreate optical continuity by inserting a low-cost plastic optical fiber 9, which optically connects the output 8 of the last device 6 to the optical input 10 of the remote and non-aligned one 15. The optical fiber is inserted within the same electrical panel, or, if allowed by the optical losses of the fiber, outside said panel in order to restore the optical connection between the transmitting cell of one module and

the receiving cell of the subsequent module. Usually, the command signal for the entire chain is generated by the device 4; however, if the command originates from an external source 14, the connection can be provided by means of an optical fiber 11 which connects the device 4 to a receiving optical-electronic system 12 identical to the ones already described; the other end of the fiber 11 is connected to an appropriate interface 13 which converts into optical signals the electrical signals arriving from the external control device 14. All the connections of the optical fibers occur by means of appropriate ferrules 17 suitable for adaptation and fixing.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent ones.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. System for transmitting electrical signals, suitable to be integrated in electrical devices used in electrical panels for the distribution and control of electric power, characterized in that transmission is achieved by means of two cells, one first cell (3) for transmitting the signals and one second cell (7) for receiving them, said cells being mounted on the two opposite sides of said electrical devices (4, 6), which are fixed on the standardized guides (16).
2. Transmission system according to claim 1, characterized in that said transmission (3) and reception (7) cells are constituted by solid-state devices which operate in the infrared range.
3. Transmission system according to any of the preceding claims, characterized in that the cases of said devices can be built in plastic materials which are transparent to infrared rays.
4. Transmission system according to any of the preceding claims, characterized in that the electrical signals which drive the transmission cells (3) are modulated at high frequency in order to make external artificial or natural lights irrelevant by means of the connection of a low-pass amplifier inserted with the receiving device (7).
5. Transmission system according to any of the preceding claims, characterized in that a low-cost optical fiber (9) is inserted between the transmitter stage of the last device of a chain constituted by the electrical devices, and the receiver stage of the first device of the new chain within the same electrical panel, if it is necessary to interrupt said chain, in order to restore optical connection between the transmitting cell of one module and the receiving cell of the subsequent module.
6. Transmission system according to either of claims 1-4, characterized in that a low-cost optical fiber (9) is inserted between the transmitter stage of the last device of a chain constituted by the electrical devices and outside said panel, in order to restore optical connection between the transmitting cell of one module and the receiving cell of the subsequent module.

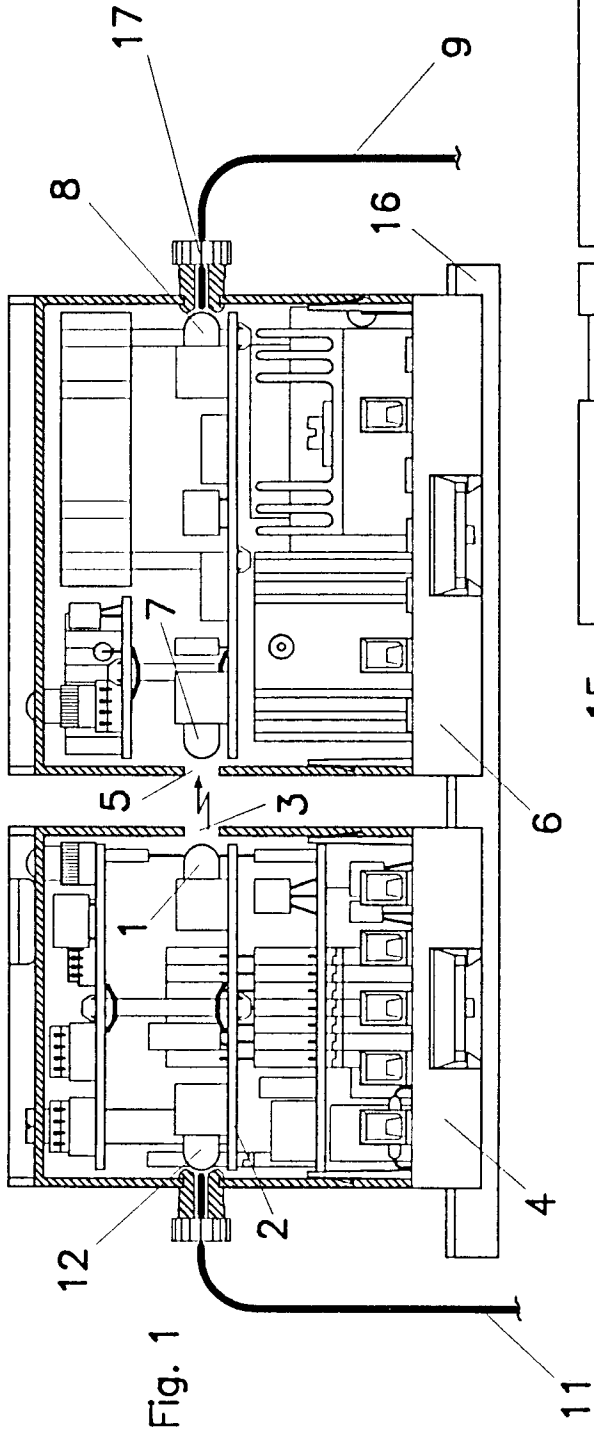


Fig. 1

Fig. 2

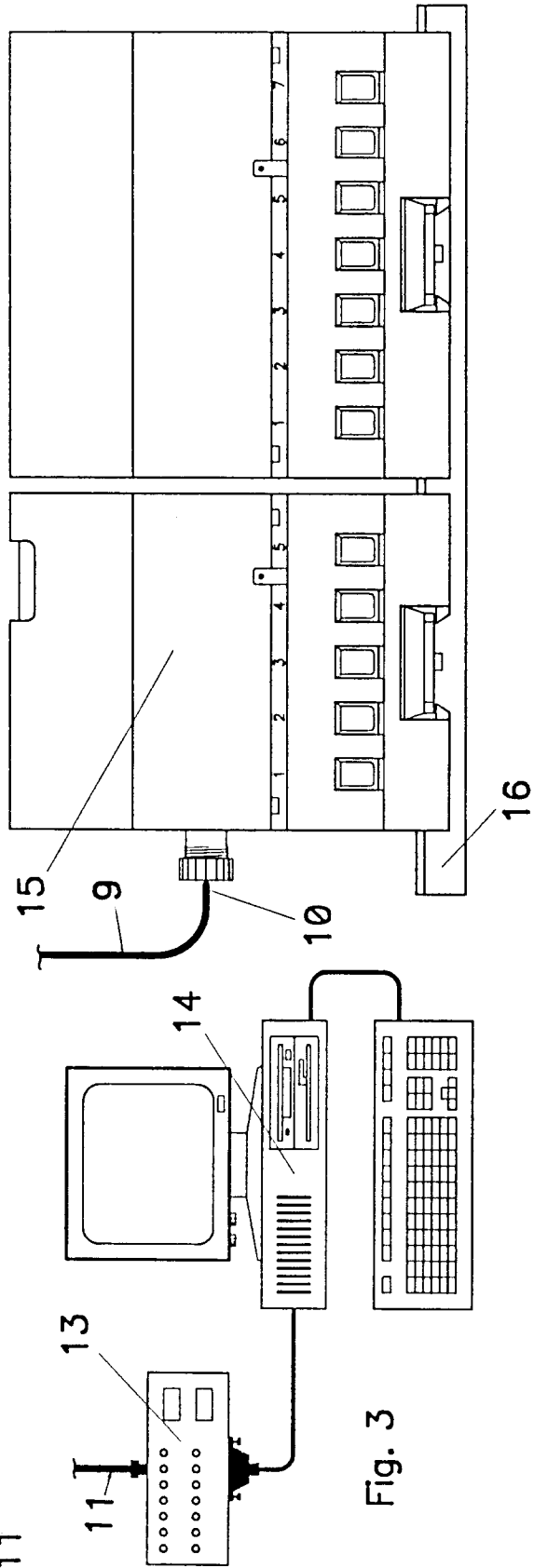
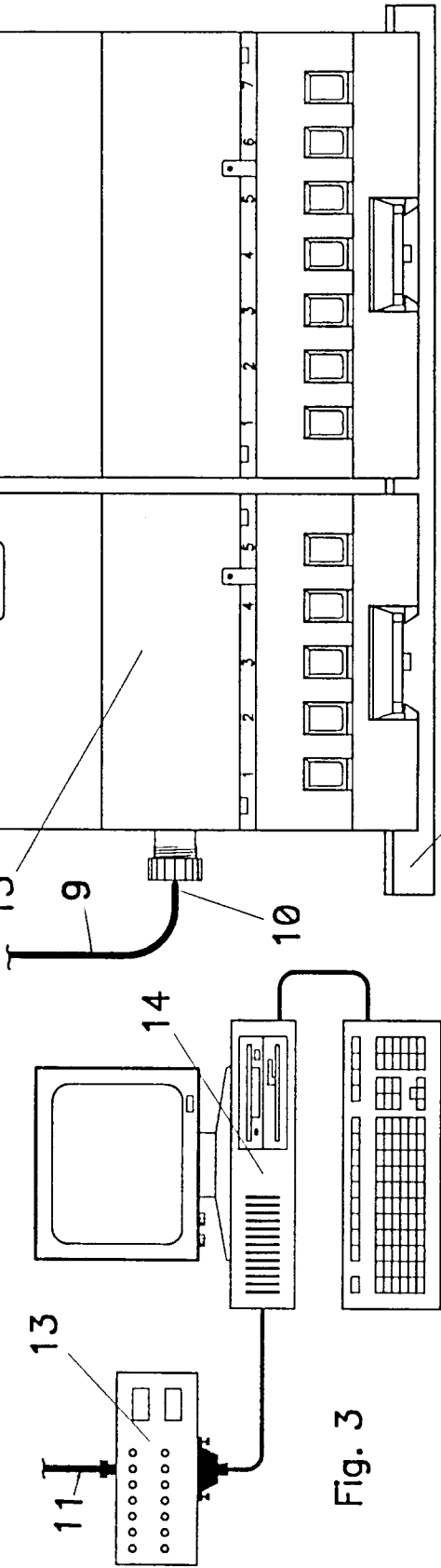


Fig. 3





| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.5) |
| X | IBM TECHNICAL DISCLOSURE BULLETIN. vol. 18, no. 7 , December 1975 , NEW YORK US page 2187 H.E.KORTH 'Optical Multichannel Connection of Integrated Modules' | 1,2,5,6 | H04B10/10 |
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| X | * page 467, left column, paragraph 3 -paragraph 4; figure 2.4 * --- | 1-3 | |
| X | EP-A-0 334 254 (SPACELABS INC.) * column 1, line 54 - column 2, line 8 * * column 5, line 27 - line 37; figure 2 * --- | 1,2 | TECHNICAL FIELDS SEARCHED (Int.Cl.5) |
| X | GB-A-2 168 214 (GEC AVIONICS LTD) * abstract; figure 1 * --- | 1,2 | H04B |
| X | US-A-4 104 533 (IVERSON) * column 2, line 8 - line 14; figure 3 * * column 2, line 32 - line 49 * --- | 4 | |
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| Y | IBM TECHNICAL DISCLOSURE BULLETIN. vol. 16, no. 11 , April 1974 , NEW YORK US pages 3523 - 3524 R.C.CLAPPER ET AL 'Optical Data Coupler' | 3 | |
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| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 25 November 1993 | Examiner Goudelis, M |
| CATEGORY OF CITED DOCUMENTS | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons ----- & : member of the same patent family, corresponding document | |
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